



## Molded Chip Tantalum Capacitors

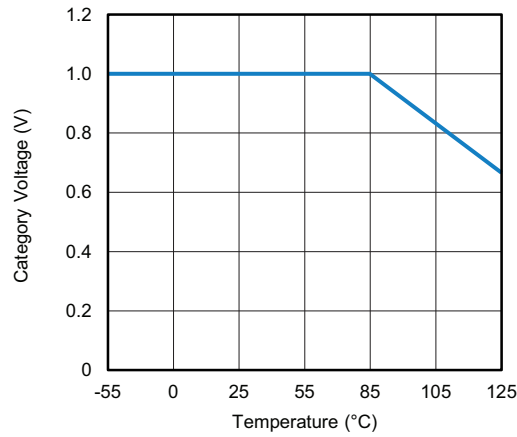
CAPACITOR ELECTRICAL PERFORMANCE CHARACTERISTICS				
ITEM	PERFORMANCE CHARACTERISTICS			
Category temperature range	-55 °C to +85 °C (to +125 °C with voltage derating)			
Capacitance tolerance	± 20 %, ± 10 %. Tested via bridge method, at +25 °C, 120 Hz			
Dissipation factor	Limit per Standard Ratings table. Tested via bridge method, at 25 °C, 120 Hz			
ESR	Limit per Standard Ratings table. Tested via bridge method, at 25 °C, 100 kHz			
Leakage current	After application of rated voltage applied to capacitors for 5 min using a steady source of power with 1 kΩ resistor in series with the capacitor under test, leakage current at 25 °C is not more than 0.01 CV or 0.5 μA, whichever is greater. <i>Note that the leakage current varies with temperature and applied voltage. See graph below for the appropriate adjustment factor.</i>			
Capacitance change by temperature	+20 % max. (at +125 °C) +10 % max. (at +85 °C) -10 % max. (at -55 °C)			
Reverse voltage	Capacitors are capable of withstanding peak voltages in the reverse direction equal to: 10 % of the DC rating at +25 °C 5 % of the DC rating at +85 °C Vishay does not recommend intentional or repetitive application of reverse voltage			
Ripple current	For maximum ripple current values (at 25 °C) refer to relevant datasheet. If capacitors are to be used at temperatures above +25 °C, the permissible RMS ripple current (or voltage) shall be calculated using the derating factors: 1.0 at +25 °C; 0.9 at +85 °C; 0.4 at +125 °C			
Maximum operating and surge voltages vs. temperature	<b>+85 °C</b>		<b>+125 °C</b>	
	<b>RATED VOLTAGE (V)</b>	<b>SURGE VOLTAGE (V)</b>	<b>CATEGORY VOLTAGE (V)</b>	<b>SURGE VOLTAGE (V)</b>
	4	5.2	2.7	3.4
	6.3	8	4	5
	10	13	7	8
	16	20	10	12
	20	26	13	16
	25	32	17	20
	35 <sup>(3)</sup>	46	23	28
	35 <sup>(4)</sup>	42	23	28
	50	65	33	40
	50 <sup>(1)</sup>	60	33	40
	63	75	42	50
75 <sup>(2)</sup>	75	50	50	
Recommended voltage derating guidelines (below 85 °C) <sup>(5)</sup>	<b>VOLTAGE RAIL (V)</b>		<b>CAPACITOR VOLTAGE RATING (V)</b>	
	≤ 3.3		6.3	
	5		10	
	10		20	
	12		25	
	15		35	
	24		50 or series configuration	
	28		63 or series configuration	
≥ 32		75 or series configuration		

**Notes**

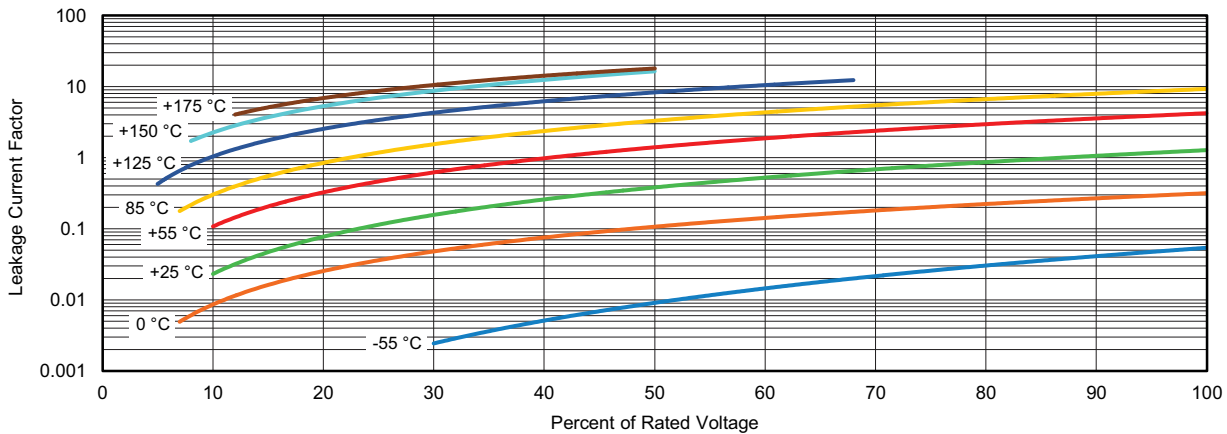
- All information presented in this document reflects typical performance characteristics
- For more information about recommended voltage derating see: [www.vishay.com/doc?40246](http://www.vishay.com/doc?40246)
- (1) Capacitance values 15 μF and higher
- (2) For 293D and TR3 only
- (3) Capacitance values lower than 33 μF
- (4) Capacitance values 33 μF and higher
- (5) For temperatures above +85 °C the same voltage derating ratio is recommended, but with respect to category voltage: up to +85 °C: category voltage = rated voltage; at +125 °C: category voltage = 2/3 of rated voltage, between these temperatures it decreases linearly - see graph below



## CATEGORY VOLTAGE VS. TEMPERATURE



## TYPICAL LEAKAGE CURRENT TEMPERATURE FACTOR



### Note

- At +25 °C, the leakage current shall not exceed the value listed in the Standard Ratings table.
- At +85 °C, the leakage current shall not exceed 10 times the value listed in the Standard Ratings table.
- At +125 °C, the leakage current shall not exceed 12 times the value listed in the Standard Ratings table.
- At +150 °C, the leakage current shall not exceed 15 times the value listed in the Standard Ratings table.
- At +175 °C, the leakage current shall not exceed 18 times the value listed in the Standard Ratings table.



ENVIRONMENTAL PERFORMANCE CHARACTERISTICS			
ITEM	CONDITION	POST TEST PERFORMANCE	
Surge voltage	Post application of surge voltage (as specified in the table above) in series with a 33 Ω resistor at the rate of 30 s ON, 30 s OFF, for 1000 successive test cycles at 85 °C.	Capacitance change Dissipation factor Leakage current	Within ± 10 % of initial value Initial specified limit Initial specified limit
Life test at +85 °C	1000 h application of rated voltage at 85 °C. MIL-STD-202, method 108	Capacitance change Dissipation factor Leakage current	Within -20 % / +10 % of initial value Initial specified limit Shall not exceed 125 % of initial limit
Life test at +125 °C	1000 h application 2/3 of rated voltage at 125 °C. MIL-STD-202, method 108	Capacitance change Dissipation factor Leakage current	Within -20 % / +10 % of initial value Initial specified limit Shall not exceed 125 % of initial limit
Humidity tests	At 60 °C / 90 % RH 1000 h, biased	Capacitance change Dissipation factor Leakage current	Within -10 % / +20 % of initial value Not to exceed 150 % of initial limit Shall not exceed 200 % of initial limit
Thermal shock	MIL-STD-202, method 107, test condition A (-55 °C / +85 °C, for 1000 cycles)	Capacitance change Dissipation factor Leakage current	Within ± 10 % of initial value Initial specified limit Initial specified limit

MECHANICAL PERFORMANCE CHARACTERISTICS			
TEST CONDITION	CONDITION	POST TEST PERFORMANCE	
Terminal strength / shear force test	Apply a pressure load of 17.7 N for 60 s horizontally to the center of capacitor side body.	Capacitance change Dissipation factor Leakage current	Within ± 10 % of initial value Initial specified limit Initial specified limit
		There shall be no mechanical or visual damage to capacitors post-conditioning.	
Vibration	MIL-STD-202, method 204, condition D, 10 Hz to 2000 Hz, 20 g peak, 8 h, at rated voltage	Electrical measurements are not applicable, since the same parts are used for shock (specified pulse) test. There shall be no mechanical or visual damage to capacitors post-conditioning.	
Shock (specified pulse)	MIL-STD-202, method 213, condition I, 100 g peak	Capacitance change Dissipation factor Leakage current	Within ± 10 % of initial value Initial specified limit Initial specified limit
		There shall be no mechanical or visual damage to capacitors post-conditioning.	
Resistance to soldering heat	Recommended reflow profiles temperatures and durations are located within the Capacitor Series Guides MIL-STD-202, method 210, condition B	Capacitance change Dissipation factor Leakage current	Within ± 10 % of initial value Initial specified limit Initial specified limit
		There shall be no mechanical or visual damage to capacitors post-conditioning.	
Solderability and dissolution of metallization	MIL-STD-202, method 208, ANSI/J-STD-002, test B (SnPb) and B1 (lead (Pb)-free). Dissolution of metallization: method D. Does not apply to gold terminations.	There shall be no mechanical or visual damage to capacitors post-conditioning.	
Flammability	Encapsulation materials meet UL 94 V-0 with an oxygen index of 32 %.		